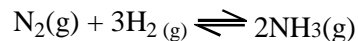


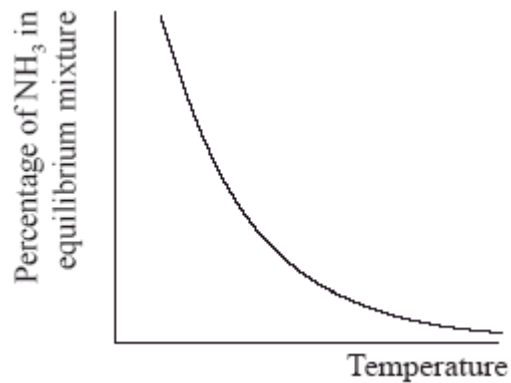
### “Warm-up” Topic 7 Review

The Haber process enables the large-scale production of ammonia needed to make fertilizers.

The equation for the Haber process is given below.



The percentage of ammonia in the equilibrium mixture varies with temperature.



- (i) Use the graph to deduce whether the forward reaction is exothermic or endothermic and explain your choice.(2)
- (ii) State and explain the effect of increasing the pressure on the yield of ammonia.(2)
- (iii) Explain the effect of increasing the temperature on the rate of reaction.(2)

**(Total 6 marks)**

(i) exothermic;

*Accept either of the following for the second mark.*

increasing temperature favours endothermic/reverse reaction;  
as yield decreases with increasing temperature;

2 max

(ii) yield increases / equilibrium moves to the right / more ammonia;  
increase in pressure favours the reaction which has fewer  
moles of gaseous products;

2

(iii) (rate increases because) increase in frequency (of collisions);  
increase in energy (of collisions);  
more colliding molecules with  $E \geq E_a$ ;

2 max

**[6]**